POTENTIAL NATURAL GAS PIPE LINE AT UNIVERSITI MALAYSIA PAHANG LABORATORY AND RESIDENTIAL COLLEGE UNIT FOR FUTURE DEVELOPMENT

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ABSTRAK

Penggunaan tenaga meningkat akibat pertumbuhan ekonomi yang pesat di Malaysia. Menyedari pentingnya tenaga, gas asli dapat menjadi sumber tenaga alternatif yang lebih berkesan dan murah berbanding dengan punca kuasa. Tujuan utama dari projek ini adalah untuk merancang pusat pengedaran gas asli untuk semua unit asrama pelajar di Universiti Malaysia Pahang (UMP) yang terletak di Gambang, Kuantan. UMP terletak berhampiran dengan stesen minyak perkhidmatan, sekitar 500 m dengan stesen perkhidmatan gas yang ada di Gambang, itu adalah cara mudah untuk ambil gas asli pada titik masa depan UMP. Saat ini, kantin pelajar menggunakan LPG untuk memasak dan tidak terus menerus bekalan dan boleh mengganggu pengeluaran mereka. Selain itu, mahasiswa juga mempunyai pemanas air di asrama mereka, sehingga akan mempengaruhi bil elektrik untuk setiap bulan. Ruang lingkup projek ini adalah pengambilan permintaan beban yang boleh menampung untuk semua unit kuliah perumahan dan kantin pelajar, perhitungan rangkaian paip dengan menggunakan persamaan Cox perhitungan beban dan menentukan klasifikasi pembinaan polyethylene paip, dan terakhir menggunakan software PDMS untuk merekacipta sistem paip. Kaedah yang digunakan adalah untuk mengira semua saiz paip dan permintaan gas beban dengan menggunakan persamaan Cox's menurut ASME B31.8 mengikut seperti MS930 dan ASME untuk memastikan bahawa sistem paip selamat untuk pembinaan. Akibatnya, penurunan jumlah tekanan dari sumber ke pengguna tidak melebihi 15% yang diterima untuk merancang paip. Medium Density polyethylene (MDPE) paip digunakan untuk pembangunan pusat pengedaran. Terkini, saiz paip untuk paip MDPE adalah 2 inci dan 3 inci. Sebagai kesimpulan, gas alam dapat mengurangkan sekitar 50% kos penggunaan dibandingkan dengan kuasa electric.

ABSTRACT

The consumption of energy has increased as result of rapid economic growth in Malaysia. Realizing the importance of energy, natural gas can be alternative energy source which is more effective and cheap compared to electricity. The main objective of this project is to design the distribution line of natural gas to all residential college units (UKK) at Universiti Malaysia Pahang (UMP) located at Gambang, Kuantan. UMP is located near to gas service station, approximately 500 m with the existing gas service station in Gambang, it is convenient way to tap the natural gas at future point to UMP. Currently, student's cafeteria using LPG bulk storage for cooking and it is not continuously supply and can disturb their production. Besides that, student also have water heater in their hostel, thus it will affect the electricity bill for every month. The scope of this project are the consumption of load demand that can accommodate for all residential college unit and student's cafeteria, network piping calculation using Cox's equation by calculation of load and determine the classification of polyethylene pipe construction, and lastly using PDMS software to draw the pipeline. The method that been used are to calculate all piping size and gas load demand by using Cox's equation according to standard such as MS930 and ASME B31.8 to make sure that the piping design is safe for the construction. As the result, the total pressure drop from the source to load consumer is below 15% which is acceptable for designing pipeline. The Medium Density polyethylene (MDPE) pipe is use for distribution line construction. Lastly, the piping sizes for MDPE pipe are 2 inches and 3 inches. As the conclusion, natural gas can reduce about 50% the utilities cost compare to electricity.

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PE	-	Polyethylene Pipe
MDPE	-	Middle Density Polyethylene Pipe
HDPE	-	High Density Polyethylene Pipe
DS	-	District Station
ST	-	Services Station.
3D	-	3 Dimension
PDMS	-	Plant Design Management System
ASME	-	The American Society of Mechanical Engineers
KK4	-	Residential College 4
CHP	-	Combined Heat Power
P	-	Pressure
Q	-	Flow rates
L	-	Distance
S	-	Specific gravity
K	-	Coefficient
Hr	-	Hour
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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Pipeline is a line or series of pipes which accompany valves, pump and other to transport liquid or gases through it. Pipeline is the good transport travelling, typically in a liquid or gaseous state though in certain instances solids can be transported through pipelines. The most economically substantial pipeline is most suitable to transporting natural gas and oil. It is because the cost of transporting amount of natural gas across land is lower and having larger capacity compares using the railroad transportation or tank treller. Pipelines may be able to provide a long-term solution for transportation. Pipelines are typically constructed from plastic or steel, and built above ground level and underground at a depth of about three feet (Pipeline-transportation-166504)

Natural gas is transported from large pipelines through smaller pipe to be used by home, industries and business. The compressor will be used to pressurize the natural gas for travel. In this study we use the polyethylene pipe of choice in distribution piping,

because it most suitable for high density and underground level. Polyethylene gas pipes are also lightweight, non-corrosive, available in long distance, and easy to install by heat fusion or mechanical fittings. For these reasons, they have been proven and used since the 1960's. Normally, pipe type used for distributes oil and gas to the consumer (Osiadacz, 1987).

1.1.1 Problem Statement

Currently, laboratories at University Malaysia Pahang (UMP) utilize energy from electricity to operate the equipments per day. For example chiller and heater required respectively for operation during laboratory session. It shows that much energy will be utilized per lab session and may lead for higher operational cost as well increase the utility bills. Apart from that, others unit named Combined Heat Power (CHP) which located at FKKSA laboratory required natural gas (NG) are totally utilized and lead to insufficient supply of natural gas. Commonly, CNG is stored in bulk storage, to fill up the compressed natural gas, some procedure need to be taken into account and lead to time consumption. Due to that it may create a problem when running the CHP and other equipments.

1.1.2 Objective

The aims of this research are to design a distribution pipeline of natural gas at University Malaysia Pahang (UMP).

1.1.3 Scope of Study

1. The scope of this research to supply directly of natural gas to all equipment in FKKSA and FKASA laboratory which use natural gas.
2. To design the distribution natural gas piping system in UMP by referring at UMP map and other information.
3. The network piping calculation can be made by calculations the loads of consumption using a certain formula and also determine the classification of polyethylene pipe construction.
4. PDMS software is used to draft and draw pipelines and to choose the most suitable network drawing.

1.1.4 Rational and Significance

The significant of the research can be best described as, by using the natural gas to generate the electricity it can reduce the cost utility bill. The use of natural gas, a clean environment friendly fuel has contributed to a reduction in emissions. With increasing environment consciousness and responsibility on the part of industries in Malaysia, the benefit as becoming an important consideration in future and a step forward towards sustainable for the country.

CHAPTER 2

LITERITURE RIVIEW

2.1 Introduction of Gas System

Pipelines are seen as one of the most practical and economically effective modes for transporting dangerous and flammable substances, such as natural gas, for which road or rail transportation is often impractical. In most countries, the more that pipeline systems are expanded and natural gas consumption increases, the more their economies become dependent on the stable, continuous and safe operation of these facilities (Papadakis GA, 1997).

In gas system design, there are two categories of system which are transmission and distribution. For transmission, it only refers to natural gas where the natural gas will deliver from upstream and downstream by using transmission line. Meanwhile for distribution, it can consist of natural gas and liquefied petroleum gas. Distribution is where the fuel either natural gas or liquefied gas is distributed to consumer（Zulkefli Y, 2007).

2.2 Properties of Natural Gas

Natural gas is considered a fossil fuel and consists of methane (CH_4). It may also contain ethane (C_2H_6), propane (C_3H_8), butane (C_4H_{10}) and others. It has certain properties that enable its use for industrial or domestic purpose, such as, contains non-poisonous ingredients that when inhaled gets absorbed into our body. It is also tasteless and colorless and when it mixed with suitable amount of air and ignited, it will burn with clean blue flame. It is considered as the cleanest burning fuels and producing carbon dioxide and water as same as breathing. Natural gas is lighter than air (SG_{NG}=0.6, SG_{air}=1.0), and tends to disperse into the atmosphere (A. Roley, 1997).

Natural gas only ignites when there is an air and gas mixture and the percent of natural gas is between 5 to 15 percent. A mixture containing less or greater, natural gas would not ignite. Natural gas contains very small quantities of nitrogen (N_2), carbon dioxide (CO_2), sulfur components and water. It leads to the formation of a pure and clean burning product that is efficient to transport (Gas Malaysia Sdn Bhd).

Natural gas is the cleanest burning fossil fuel available that can leads to a cleaner environment. It can help improve the quality of the air and water. Natural gas burns to produce no harmful pollutants and is a highly reliable fuel for domestic use.

2.3 Distribution system

Main service and meters are required to distribute gas to the ultimate consumers continuously get the natural gas. The design of the new systems and addition to and renewals of existing systems is a branch of the gas engineering. The primary objective of a good design is to supply the market demand of any customer in the system with minimum cost and follow the safety practices (Cornell, 1959).

The ultimate in successful design is too able to offer adequate gas service economically to any customer within the service or franchised area. The degree to which a distribution system fails to provide such service reflects upon the engineering- design practices of the utility involved (Cornell, 1959).

For designing gas pipeline systems, Cox's equation and pole's equation are employed. Basically, for the Cox' method, the allowable pressure must be 29.4 kpag or 3000 mmH_2O or above. The pressure drop of the size pre-determined before to each appliances system shall be calculated by Cox's Formula as shown below. However, the maximum allowable pressure drop is only 15% of the supply pressure. Otherwise, it is a must to select bigger pipe size for that section in order to provide sufficient pressure or pressure drop within 15% of the supply pressure.

Cox's equation:

$$Q = K \sqrt{\frac{(P_1^2 - P_2^2)D^5}{SL}}$$

$$P_2 = \sqrt{\frac{P_1^2 - (SQ^2L)}{K^2D^5}}$$

(Zulkefli Y, 2007)

Where:

P_1^2 = inlet pressure, kPa.abs

$P_2 2$ = outlet pressure, kPa.abs

S = specific gravity of gas

Q = Flow rate, Sm^3/hr

L = Distance, meter

D = pipe diameter, mm

K = Cox's Coefficient, 1.6×10^{-3}

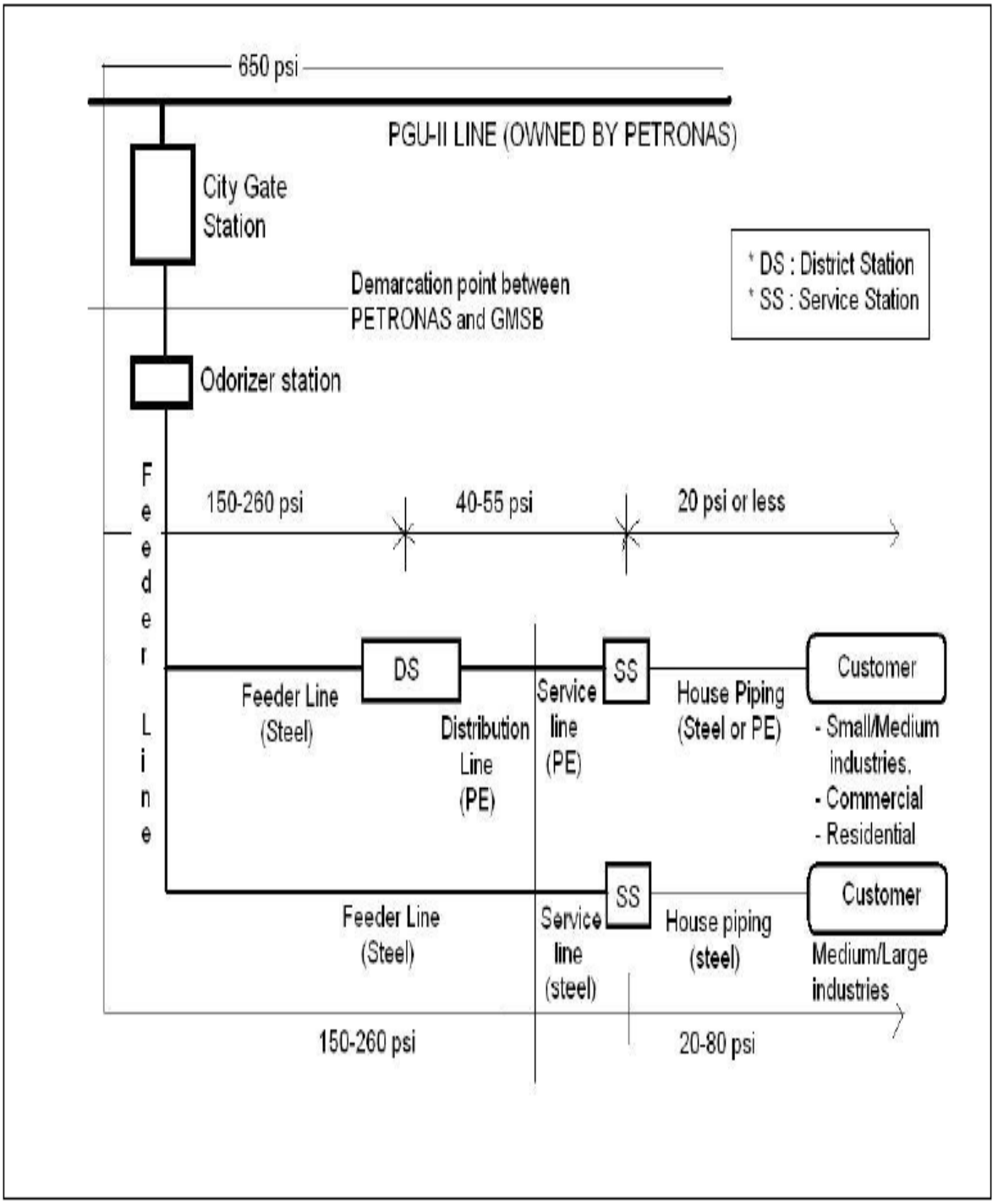

Figure 2.1: Outline of gas Malaysia natural gas supply system. (K. Yamaguchi, 1994) Outline of Gas Malaysia Natural Gas supply System. In: Gas Malaysia Sdn. Bhd. Technical Department. Malaysia.

2.3.1 Design of Pipeline

Cornell et. al. (1959) mentioned that before the pipeline project can be done/establish; there are some steps that must be done. These steps is a simple guidelines which already be done from the previous engineer/contractor that dealt with pipeline project. Steps in a pipeline project are:

1. Market survey – immediate and prospects for growth.
2. Pipe size and working pressure.
3. Pipe specifications.
4. Map of tentative route.
5. Bill of materials.
6. Total cost estimate.
7. Certificate of convenience and necessity.
8. Right of way.
9. Construction survey.
10. Construction contract.
11. Construction.
12. Testing.
13. Putting in service.